

"Silicon Processing for the VLSI Era", Volume 1, pages 133-136 and 303-306, is respectfully traversed. The rejection is believed to be incorrect for the reasons set forth hereinafter.

Claim 1, the only independent claim, is directed to a process for fabricating a semiconductor device having a buried layer and it requires the steps of:

1. forming a buried implanted impurity region at a location which is spaced below the surface of a substrate where a buried layer is to be formed in the substrate;
2. placing the substrate inside a reactor furnace and carrying out the following steps while the substrate is maintained in the reactor furnace:
 - (a) providing a non-oxidizing atmosphere inside the furnace;
 - (b) annealing the substrate to activate implanted impurity ions and diffuse the buried implanted impurity ion region both upwardly and downwardly from the location below the surface of the substrate while increasing the reactor temperature up to a first temperature; and
 - (c) before the buried ion implanted region beneath the surface expands upwardly from the location below the surface of the substrate sufficiently to reach the surface of the substrate, changing the internal temperature of the reactor furnace from the first temperature to a second temperature at which an epitaxial crystal starts to grow on the surface and introducing an epitaxial growth gas into the reactor furnace to cause an epitaxial layer to grow on the surface of the substrate, thereby inhibiting autodoping and formation of crystal defects in the epitaxial layer; and ,
- 3.. then removing the substrate from the reactor furnace.

With this method, as described, for example, at pages 13 and 14 in the specification, an implanted ion region beneath the surface of the substrate is produced in such a way that there is no chance that crystal defects are produced in the substrate surface and no autodoping of the epitaxial layer is caused. Consequently, there is less chance that crystal defects will be formed in the epitaxial growing process.

This unique method is not disclosed in or in any way suggested by the prior art relied upon in support of the rejection. In connection with the Japanese reference, the applicant's attorney noted reference to the Translations Branch of the PTO in the copy of the reference supplied to the applicant and asked the Examiner whether an English translation had been prepared by the Patent Office and, if so, requested a copy. The Examiner advised that no English translation had been prepared and that only the English language text of the abstract is relied upon in the Action.

It is apparent from the English language text that the Japanese reference in no way supports statements made in the Examiner's Action regarding that reference. As stated in the abstract, a silicon substrate having a high concentration buried layer is prepared by implanting a p-type or n-type impurity to a predetermined amount followed by implantation of fluorine ions. "Next", an anneal is performed for activating the p-type or n-type impurity and "then" single crystal silicon is epitaxially grown onto a buried layer. There is nothing in the abstract that states or in any way implies that the various steps are carried out "all in the same reactor furnace" and there is no basis for the Examiner's contention that the Japanese reference discloses that.

Furthermore, the Examiner's contention that, "because oxide formation and removal prior to epitaxial growth are not depicted" does not properly support the conclusion that the anneal must be carried out in a nonoxidizing atmosphere. There is nothing anywhere in the abstract that states or implies that no oxide layer is formed and removed prior to epitaxial growth and the use of the word "next" in the Abstract and does not mean that such oxide formation and removal are not part of the annealing process. Thus, the Examiner's contention that the absence of such a statement requires the anneal to have been carried out in a non-oxidizing atmosphere is groundless.

Similarly, the contention that "Heating of the substrate for some time period after the anneal step is in practice unavoidable when desiring to fully activate the implanted ions" is merely speculation on the Examiner's part and is unsupported by the disclosure of the Japanese abstract or of the other reference, Wolf. Moreover, the statement has no relation to the requirements of the claims which do not specify any time periods with respect to heating of the substrate.

Similarly, the contention that "It also would have been within the scope of one or ordinary skill in the art to perform the epitaxial growth without cooling the wafer after annealing and diffusion of the implanted ions because cooling of the wafer is not disclosed as necessary by Japan '833 and because the epitaxial growth temperature is higher than the annealing and diffusion temperature" is also completely unfounded.

Again, the total absence of any reference to temperatures in the Japanese reference or to any sequence of events with respect to temperature cannot be construed to specify a relationship of temperatures or an order of temperature levels. Any such contention is

factually unsupported speculation on the part of the Examiner based on hindsight reconstruction of the reference.

Thus, the Japanese reference does not disclose or in any way suggest the specific requirements of claim 1 for placing a substrate inside a reactor furnace and while maintaining the substrate in the reactor furnace, providing a non-oxidizing atmosphere annealing and before the buried ion implanted region expands upwardly sufficiently to reach the surface of the substrate, changing the internal temperature of the reactor furnace while increasing the temperature to a second temperature at which epitaxial crystal growth starts and Wolf is also utterly lacking in any such teaching or suggestion of those important requirements of the process.

It is well established that unsupported assertions such as "it would have been within the scope of one of ordinary skill in the art" do not provide a proper factual basis for a conclusion that a claimed invention is obvious in the absence of a suggestion in the art that the claimed steps should be carried out.

In this regard, the Court of Appeals for the Federal Circuit, in its recent decision in *In re Dembiczac*, 175 F.3d 1994, 50 USPQ2d 1614 (Fed. Cir. 1999), summarized the current law relating to obviousness of an invention and emphasized the need for a teaching, motivation or suggestion in the prior art to combine or modify the reference disclosures in the following manner (175 F.3d at 1000, 50 USPQ2d at 1616-1617):

A claimed invention is unpatentable if the difference between it and the prior art "are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art." 35 U.S.C. § 103(a) (Supp. 1998); see *Graham v. John Deere Co.*, U.S. 1, 14, 148 USPQ 459, 465 (1966). The ultimate determination of whether an invention is or is not obvious is a legal

conclusion based on underlying factual inquiries including: (1) the scope and content of the prior art; (2) the level of ordinary skill in the prior art; (3) the differences between the claimed invention and the prior art; and (4) objective evidence of nonobviousness, *See Graham*, 383 U.S. at 17-18, 148 USPQ at 467; *Miles Labs, Inc. v. Shandon Inc.*, 997 F.2d 870, 877, 27 USPQ2d 1123, 1128 Fed. Cir. 1993). We therefore review the ultimate determination of obviousness without deference to the Board, while examining any factual findings for clear error. *See, e.g., In re Zurko*, 142 F.3d 1447, 1459, 46 USPQ 2d 1691, 1700 (Fed. Cir.) (en banc), *cert. granted*, 119 S. Ct. 401 (1998).

* * * *

Our analysis begins in the text of section 103 quoted above, with the phrase "at the time the invention was made." For it is this phrase that guards against entry into the "tempting but forbidden zone of hindsight," see *Loctite Corp. v. Ultraseal Ltd.*, 781 F.2d 861, 873, 228 USPQ 90, 98 (Fed. Cir. 1985), *overruled on other grounds by Nobel-pharma AB v. Implant Innovations, Inc.*, 141 F.3d 1059, 46 USPQ2d 1097 (Fed. Cir. 1998), when analyzing the patentability of claims pursuant to that section. Measuring a claimed invention against the standard established by section 103 requires the oft-difficult but critical step of casting the mind back to the time of invention, to consider the thinking of one of ordinary skill in the art, guided only by the prior art references and the then-accepted wisdom in the field. *See, e.g., W.I. Gore & Assoc. Inc. v. Garlock, Inc.*, 721 F.2d 1540, 1553, 220 UPSQ [USPQ]303, 313 (Fed. Cir. 1983). Close adherence to this methodology is especially important in the case of less technologically complex inventions, where the very ease with which the invention can be understood may prompt one "to fall victim to the insidious effect of a hindsight syndrome wherein that which only the inventor taught is used against its teacher." *Id.*

Our case law makes clear that the best defense against the subtle but powerful attraction of a hindsight-based obviousness analysis is rigorous application of the requirement for the showing of the teaching or motivation to combine prior art references. *See, e.g., C.R. Bard, Inc. v. M3 Sys. Inc.*, 157 F.3d 1340, 1352, 48 USPQ2d 1225, 1232 (Fed. Cir. 1998) (describing "teaching or suggestion or motivation [to combine]" as an "essential evidentiary component of an obviousness holding."); *In re Rouffet*, 149 F.3d 1350, 1359, 47 USPQ2d 1453, 1459 (Fed. Cir. 1998) ("the Board must identify specifically . . . the reasons one of ordinary skill in the art would have been motivated to select the references and combine them"); *In re Fritch*, 972 F.2d 1260, 1265, 23 USPQ2d 1780, 1783 (Fed. Cir. 1992) (examiner can satisfy burden of obviousness in light of

combination "only by showing some objective teaching [leading to the combination]"); *In re Fine*, 837 F.3d 1071, 1075, 5 USPQ2d 1596, 1600 (Fed. Cir. 1988) (evidence of teaching or suggestion "essential" to avoid hindsight); *Ashland Oil, Inc. v. Delta Resins & Refractories, Inc.*, 776 F.2d 281, 297, 227 USPQ 657, 667 (Fed. Cir. 1985) (district court's conclusion of obviousness was error when it "did not elucidate any factual teachings, suggestions or incentives from this prior art that showed the propriety of combination"). *See also Graham*, 383 U.S. at 18, 148 USPQ at 467 ("strict observance" of factual predicates to obviousness conclusion required). Combining prior art references without evidence of such a suggestion, teaching, or motivation simply takes the inventor's disclosure as a blueprint for piecing together the prior art to defeat patentability -- the essence of hindsight. See, e.g., *Interconnect Planning Corp. v. Feil*, 774 F.2d 1132, 1138, 227 USPQ 543, 547 (Fed. Cir. 1985) ("The invention must be viewed not with the blue-print drawn by the inventor, but in the state of the art that existed at the time."). In this case, the Board fell into the hindsight trap.

We have noted that evidence of a suggestion, teaching, or motivation to combine may flow from the prior art references themselves, the knowledge of one of ordinary skill in the art, or, in some cases, from the nature of the problem to be solved, see *Pro Mold & Tool Co. v. Great Lakes Plastics, Inc.* 75 F.3d 1568, 1573, 37 USPQ2d 1626, 1630 (Fed. Cir. 1996), *Para-Ordinance Mfg. v. SGS Imports Intern., Inc.* 73 F.3d 1085, 1088, 37 USPQ2d 1237, 1240 (Fed. Cir. 1995), although "the suggestion more often comes from the teachings of the pertinent references," *Rouffet*, 149 F.3d at 1355, 47 USPQ2d at 1456. The range of sources available, however, does not diminish the requirement for actual evidence. That is, the showing must be clear and particular. *See, e.g., C.R. Bard*, 157 F.3d at 1352, 48 USPQ2d at 1232. Broad conclusory statements regarding the teaching of multiple references, standing alone, are not "evidence". *E.g., McElmurry v. Arkansas Power & Light Co.*, 995 F.2d 1576, 1578, 27 USPQ2d 1154, 1164, 196 USPQ 209, 217 (CCPA 1977), ("The examiner's conclusory statement that the specification does not teach the best mode of using the invention is unaccompanied by evidence or reasoning and is entirely inadequate to support the rejection."). In addition to demonstrating the propriety of an obviousness analysis, particular factual findings regarding the suggestion, teaching, or motivation to combine serve a number of important purposes, including: (1) clear explication of the position adopted by the Examiner and the Board; (2) identification of the factual disputes, if any, between the applicant and the Board; and (3) facilitation of review on appeal. Here, however, the Board did not make particular findings regarding the locus of the suggestion, teaching, or motivation to combine the prior art references.

Another pertinent decision is *In re Mills*, 916 F.2d 680, 16 USPQ2d 1430 (Fed.Cir. 1990), in which the Court of Appeals for the Federal Circuit reversed a rejection based on obviousness because the prior art did not suggest the necessary modification of the disclosed structure, stating (916 F.2d at 682, 16 USPQ2d at 1432):

We note first that non-obviousness is a question of law to be determined from the facts. *Stratoflex, Inc. v. Aeroquick Corp.*, 713 F.2d 1530, 1535, 218 USPQ 871, 876 (Fed.Cir. 1983). We review the Board's determination of obviousness, based on the scope and content of the Mathis reference and the differences between the Mathis reference and the Mills claims, for correctness or error. *In re Carleton*, 599 F.2d 1021, 1024 n.14, 202 USPQ 165, 169 n.14 (CCPA 1979).

After reviewing the record, the arguments in the briefs, and the Mathis reference, we conclude that Mathis would not have rendered the claimed invention obvious. The closest Mathis comes to suggesting Mills' claimed apparatus is at column 3, lines 42-47, which states:

[T]he rate at which the inlet 2b receives a solid constituent depends on the speed of the feed screw 4. Such speed can be regulated by a prime mover 6 which includes a variable-speed transmission.

This brief reference contains no suggestion of "pump means and the feed means providing a pumping capacity of the pump means greater than the feed rate of ingredients to the mixing chamber provided by the feed means, such that in operation air is drawn into the mixing chamber, and air entrained in the mixed ingredients," as provided for in Mills' claim 6. While Mathis' apparatus may be capable of being modified to run the way Mills' apparatus is claimed, there must be a suggestion or motivation in the reference to do so. See *In re Gordon*, 733 F.2d 900, 902, 221 USPQ 1125, 1127 (Fed.Cir. 1984) ("The mere fact that the prior art could be so modified would not have made the modification obvious unless the prior art suggested the desirability of the modification."). We see no such suggestion. The apparatus claimed by Mills is different from that of

Mathis, since the fact that motor 6 of Mathis (the feed means) can be run at a variable speed does not require that motor 20 (connected to the pump) be run at a lesser speed" such that in operation air is drawn into the mixing chamber and air entrained in the mixed ingredients."

Also, in *In re Chu*, 66 F.3d 292, 36 USPQ2d 1089 (Fed. Cir. 1995), the Court of Appeals emphasized the necessity for a teaching or suggestion in the prior art to make changes in the prior art disclosure which would result in the claimed invention even though the required changes would be minor or simple, stating (66 F.3d at 298; 36 USPQ at 1094):

In a proper obviousness determination, "[w]hether the changes from the prior art are 'minor', . . . the changes must be evaluated in terms of the whole invention, including whether the prior art provides any teaching or suggestion to one of ordinary skill in the art to make the changes that would produce the patentee's . . . device." *Northern Telecom, Inc. v. Datapoint Corp.*, 908 F.2d 931, 935, 15 USPQ2d 1321, 1324 (Fed.Cir.), cert. denied, 498 U.S. 920 (1990). This includes what could be characterized as simple changes, as *In re Gordon*, 733 F.2d 900, 902, 221 USPQ 1125, 1127 (Fed.Cir. 1984) (Although a prior art device could have been turned upside down, that did not make the modification obvious unless the prior art fairly suggested the desirability of turning the device upside down.).

In the present case, the cited prior can be searched in vain for any teaching or suggestion that one skilled in the art would be led by the disclosures of the Japanese reference and Wolf to carry out the above-mentioned steps specified in claim 1. The necessary modifications can only be inspired by hindsight reconstruction of the prior art based on the applicant's disclosure, which is impermissible. Consequently, claim 1 is patentable over the prior art and should be allowed along with its dependent claims 3-9.

In view of the foregoing we respectfully submit that all of the claims in the application are patentable and that the application is in condition for formal allowance.

Respectfully submitted,



Dated: November 13, 2001

Francis J. Hone
Patent Office Reg. No. 18,662

BAKER BOTTS L.L.P.
30 Rockefeller Plaza
New York, New York 10112-0228
Attorney for Applicants
(212) 408-2534